

us, both by statesmen and men of science, is to the same effect, and in favour of increased State aid. It has also especially been urged upon us, that to afford, by direct pecuniary aid, the means of livelihood to men of distinction in pure investigation would be a great advantage to science, as competent investigators would thus be enabled and encouraged to pursue a strictly scientific career."

Lord Salisbury is of opinion that the cause of science is hindered by the want of a sufficient career for scientific men, giving the following statement of his reasons:—

"I am induced to think so, by noticing how very much more rapid the progress of research is where there is a commercial value attached to the results of it, than in other cases. The peculiar stimulus which has been given to electrical research, in the particular direction of those parts of it which concern the telegraph, is a very good instance in point, and the extent to which researches into organic chemistry have almost clustered themselves round the production of coal tar colours is another instance in point. And therefore it is difficult to avoid the conclusion that research is really hindered by the necessity under which those who are most competent to conduct it feel themselves, of providing for their own support by means of the talent and the knowledge which they possess."

With regard to the scale on which such remuneration or payments for maintenance should be made, Lord Salisbury observes:—

"I should say, taking the parallel [that of certain offices in the Church], to which I have already alluded, that an income of about 1,000*l.* or 1,500*l.* a year would be the kind of income which would suffice for the purpose that I have in view."

And he would also add provision for retirement.

With reference to the safeguards against abuse which would be necessary, Lord Salisbury continues:—

"... It would, for their [the investigators'] own interest, and to save them from invidious comments, be desirable to impose upon them the necessity of publishing, either in the form of books or in the form of lectures (but not sufficient in number really to impede their work), an account of the result of their labours during each successive year. Perhaps one or two stated lectures in the course of a year, to be delivered to University students, would be the best means of imposing upon them that test of industry."

Lord Derby takes the same view:—

"I think that, in one way or another, where you have a man of very great eminence as a scientific discoverer, it is unquestionably the duty of the State to provide him with means and leisure to carry on his work. Whether that is to be done by giving him an office under the British Museum, or in any similar institution, or whether it is to be done by simply granting him a pension in recognition of eminent scientific service, or in whatever other way it is done, it seems to me to be immaterial, but I certainly consider that it is a very important part of the public duty, to relieve men who have shown an eminent capacity for original discovery and research from the necessity of engaging in a lower kind of work as a means of livelihood." . . .

Sir W. Thomson, in a reply to which we have already referred, stated his opinion on this point as follows:—

"That men should be enabled to live on scientific research is a matter of most immediate consequence to the honour and welfare of this country. At present a man cannot live on scientific research. If he aspires to devote himself to it he must cast about for a means of supporting himself, and the only generally accepted possibility of being able to support himself is by teaching, and to secure even a very small income, barely sufficient to live

upon, by teaching, involves the expenditure of almost his whole time upon it in most situations, so that at present it is really only in intervals of hard work in professions that men not of independent means in this country can apply themselves at all to scientific research." . . .

Prof. Henry, the distinguished director of the Smithsonian Institution in the United States, who was good enough to appear before the Commission when he was in this country, gave the following emphatic evidence in the same direction:—

"My idea would be that if the funds were sufficient, and men could be found capable of advancing science, they should be consecrated to science, and be provided with the means of living above all care for physical wants, and supplied with all the implements necessary to investigation."

Prof. Balfour Stewart, after referring to the instances of wealthy persons who undertake scientific research in this country, points out that the number of those so circumstanced is very small in comparison with the number of able men who are willing to give their time and capacities to observations and research. He goes on to say that able men, and men competent to conduct research, suffer in this country from not having sufficient means at their disposal to proceed as they would like to do.

"Do you anticipate, then, that if there were any intelligent centre for the distribution of a sufficient fund to persons having the requisite capacities for observation and research, but not having the means, the distribution of such a fund would have any benumbing influence upon original observation and research?—No, I should think quite the contrary; it would encourage it very much."

Mr. Gore also advocates the enlargement of the present system.

"... I should strongly advocate that the present system should be enlarged, so that the investigators should not merely be reimbursed for all that they have expended, but also paid in some measure for their time and labour, because each investigator has to give up a profitable employment in order to find the time."

He then gives his own personal experience, which probably resembles that of many of those who, without private fortune, engage in pure research.

"I refuse a great many engagements in analyses and other scientific matters for the manufacturers who come to me. . . . I gave up some pupils a short time ago to enable me to have more time for original investigation."

Dr. Joule, Dr. Siemens, Mr. De la Rue, and other scientific authorities testify to the same effect, and urge the adoption of some form of remuneration for valuable work done, as a measure not merely just to the individual, but serviceable to the State by the encouragement it would afford to those able men of small means, who abound in this country, to engage in original researches of great importance to the community.

(To be continued.)

THE IRISH FISHERIES

Report of the Inspectors of Irish Fisheries on the Sea and Inland Fisheries of Ireland for 1874. Presented to both Houses of Parliament. (Dublin: Alex. Thom, 1875.)

DURING the last few years increased attention has been paid to the vast stores of food, which this country possesses, in the fish frequenting its inland

waters and territorial seas. Legislation, attended on the whole with marked success, has led to the development of the salmon fisheries of the United Kingdom; a much less successful attempt has been made to increase the produce of our exhausted oyster fisheries; and a very able Commission, which enjoyed the advantage of Prof. Huxley's assistance, has investigated and authoritatively disproved the allegation that our sea-fish were decreasing. In England and Scotland, at any rate, satisfaction is usually expressed at this state of things. With the single exception of the oyster, the harvest of the sea proves annually as productive, or even more productive, than ever, while the increasing consumption of a growing population and the greater destructiveness of modern implements of fishing, are not apparently unduly diminishing the numbers of our sea-fish. Ireland, however, to judge from the language of her representatives in Parliament, is less satisfied with her position. The very fish, if we may credit some authorities, are deserting the coasts of this unhappy country; and Irish fishermen, with their old tackle worn out, and with no money to purchase new, are emigrating to other fishing grounds on the other side of the Atlantic. The picture annually presented to us of the miserable condition of Irish fishermen was so deplorable, that Parliament, last year, was induced to interfere. The Ministry was surprised by a hurried division, and unexpectedly defeated by a narrow majority. Its defeat compelled it to place a portion of the Irish Reproductive Fund at the disposal of the Irish Inspectors of Fisheries; and the Inspectors are now enabled to lend small sums of money to needy fishermen on their personal security. No such loan has yet been made. But, on the eve of adopting a new policy, it is occasionally desirable to review the circumstances which have led to it; and we turn, for this reason, to the recently published report of the Inspectors of Irish Fisheries.

The Report is divisible into two portions. The first and shorter portion refers to Sea Fisheries, Oyster Fisheries, and Harbours; the second and longer portion to the Inland or Salmon Fisheries. The salmon fisheries of Ireland are fairly prosperous. The amendments which are required in the law are not numerous or important; and we do not therefore propose to follow the Inspectors into their review of them. But the ten pages of the Report which are devoted to the sea fisheries and oyster fisheries of Ireland, deserve for every reason most attentive consideration. The oyster fisheries occupy a very short space in the Report, and may be dealt with in the first instance. The Inspectors have exercised almost absolute powers in dealing with this question. They are authorised to appropriate to any individual who applies to them, large portions of the fore shore of Ireland, and 130 licensed beds, occupying 18,825 acres of fore shore and sea-bottom, have thus been appropriated. The result of this wholesale appropriation of public dredging ground might well have justified Parliamentary interference. "The chief object," say the Inspectors, "in granting licenses (cultivation) has not been fulfilled. In the majority of cases we believe there has not been anything deserving to be called an attempt to cultivate the ground granted. The proprietors in numerous instances content themselves with getting as much as they can for their

private use, and do nothing to replenish. We would be fully justified in cancelling the majority of the licenses." We quite agree with the Inspectors in this view; but we should like to know why some of the licenses have not already been cancelled. Two years ago the Inspectors assured us that they had "warned some licensees that their licenses will be withdrawn unless within twelve months they proceed to cultivate." The public have a right to inquire whether the warning has been attended to, and if not, why the threat of the Inspectors has not been carried out. The Inspectors, indeed, say that they have so "many pressing duties to perform," that they have been compelled to postpone attending to the oysters. But can any duty be more pressing than the restoration to the public of ground really taken from them under false pretences? The Inspectors have found time to grant five new licenses; they would have done much more to promote oyster culture if they had cancelled five old ones. "Overdredging and a succession of bad spatting years" are of course given as the cause of the growing scarcity. But it is worth while remarking that we had nothing of bad spatting years till overdredging had decreased the stock of oysters. If an oyster bed be scraped clean of all the adult oysters, no spatting season, however favourable, can be a good one.

But the most important portion of the present report is undoubtedly that which relates to the Irish Sea Fisheries. There can be no question about the decrease of Irish fishermen. In 1846, or before the famine, 113,073 men and boys were employed in 19,883 vessels and boats on this industry. In 1874 the number of vessels was reduced to 7,246! the number of hands to 26,924! The decline both in boats and men has been continuous throughout the period. But, with due deference to the Inspectors, it is easy to account for it. The "melancholy ocean" which surrounds Ireland is subject to very severe storms: and no fishing-boat can prosecute its industry consecutively throughout the year. Under such circumstances one of two things must happen—either the Irish Seas must be fished by men who, in strong weather, may resort to quieter fishing-grounds, or the Irish fisherman must combine other operations with his fishing. Before the famine the last of these things occurred. Every Irishman was a cottier. He tended his potatoes and his pig in bad weather; and he went a-fishing in calm weather. But, since the famine, the cottiers have gradually been worked out. Large farms have swallowed up small ones: and the occupiers of large farms, and their servants have no time to go out fishing. The class from which the mass of Irish fishermen were drawn had ceased, or is ceasing, to exist; and Irish fishermen are consequently decreasing in numbers. But, though Irish fishermen are decreasing, the Irish fisheries are not decaying. What do the Inspectors tell us? There were only 187 Irish boats engaged last year in the herring fishery off Howth. But there were 343 English, Scotch, and Manx boats. There were only 61 Irish boats in the mackerel fishery off Kinsale. But there were 226 English, Scotch, and Manx boats. The Englishmen, Scotchmen, and Manxmen, following the fish round the whole coasts of England, Scotland, and Ireland, beat the Irishmen, who never follow them at all. Every one has seen Cornish boats fishing for herrings in the North Sea; or Scotch boats beating the English in

their own waters. But no one ever saw an Irish fishing-boat in either a Scotch or English sea. The Englishmen and Scotchmen, with their capital continuously employed throughout the year, beat, of course, the Irishman who leaves it idle and unemployed for three-fourths of it.

The view which we have thus expressed is not, however, shared either by the friends of Ireland or the Irish Inspectors. In their eyes the decrease in the number of Irish fishermen is equivalent to the decay of the Irish fisheries ; and both of these are due to the unsympathetic attitude of this country. Last year nothing would do any good but loans. Now that the Reproductive Loan Fund has been utilised for this purpose with effects which we shall immediately notice, nothing will do any good but a safe and commodious harbour at Arklow. Such a harbour "is most necessary for the successful prosecution of both herring and oyster fisheries," and "unless something be done, there is little hope of any substantial improvement." We have no desire to discourage the construction of safe and commodious harbours, but we should like to ask the Irish Inspectors whether they ever heard of a place in England called Yarmouth. It is as important a fishing station as Arklow, it is on as stormy a shore ; but when a storm is raging, the Yarmouth fishermen have to stand out to sea to avoid being driven on to the coast. We never heard that the want of a harbour at Yarmouth had destroyed the Yarmouth fishery ; and we think that Yarmouth has at least as good a claim as Arklow for the construction of such a harbour. The new system of loans to fishermen remains for consideration. There has, of course, been no want of applicants for the loans. 2,800 individuals have already applied for the money, and we have no doubt there are a good many more quite prepared to follow their example. 1,300 of the 2,800 applications emanate from County Galway, and 160 of these applicants live in one parish. No more than six of the 160 "fulfil the conditions which should entitle them to obtain a loan !" We presume that as the Inspectors pointedly refer to the 160 applicants, they may be regarded as fair examples of the 2,800 who have applied. In that case only 105 persons throughout Ireland will, in the lenient judgment of the promoters of the policy, be entitled to participate in the loan. Is it possible to conceive a more striking illustration of the consequences of the policy ?

MAGNUS'S "ELEMENTARY MECHANICS"
Lessons in Elementary Mechanics introductory to the
Study of Physical Science, with numerous Exercises.

By Philip Magnus, B.Sc., B.A. (Longmans, 1875.)

IN order to assign any work to its proper place it is necessary that we should try to ascertain what is the author's aim in writing it, and also to see if that aim be to any fair extent attained ; further, we should take into our account the consideration of the question whether if the author's end be attained it is one worth arriving at. If the verdict on all these issues be favourable, then we may say that the *raison d'être* of the work is justified. For the aim of the present volume the title will suggest at once that the author does not attempt to produce a treatise which shall enter into comparison with such works as those produced by Thomson and Tait. Let us hear his own statement : "The lessons are intended for

the use of those who have had no previous acquaintance with the subject ;" and so he has endeavoured to bring into prominence the leading principles of Mechanics, and to exemplify them by simple illustrations. Here we may observe that the term mechanics is used in the ordinary acceptation of that word now-a-days, *i.e.*, as the science of the motion and equilibrium of bodies, and not in the Newtonian sense to which Messrs. Thomson and Tait seek again to restrict it. Starting on the hypothesis that the idea of Motion is more elementary than that of Force, since it is only from a combination of forces that equilibrium can result, the author makes the subject of Statics depend upon the laws of Dynamics. Hence the proposition, which is generally cited as that of the Parallelogram of Forces, Mr. Magnus derives at once from Newton's second Law.

After a short preliminary introduction we have "Kinematics—Motion" treated under the heads of Measurement of Motion and Falling Bodies ; then "Dynamics—Force," under which heading we have Measurement of Force, the Laws of Motion, Energy, Machines.

The second part of the book discusses "Statics—Rest," under the following heads : Theory of Equilibrium, Centre of Gravity.

The style is lucid, the solved exercises carefully chosen, the work compact. With the exception above mentioned, of Statics being made dependent on Dynamics, the arrangement and matter are much the same as we find in English treatises. An intelligent boy ought in a few months to be able to make himself master of the greater portion of this small book, which Mr. Magnus has aimed at making sufficiently elementary to be placed in the hands of a beginner. What we consider to be higher praise is that we believe it to contain nothing that the student will have to unlearn in a subsequent portion of his career. We can recommend it as a trustworthy introduction to more advanced text-books.

We have endeavoured to test its accuracy as regards the answers to the numerous questions scattered over its pages. Of these there are 279 in the Dynamical portion, 192 in the Statical portion, besides 79 questions in an appendix composed of papers from the Matriculation, South Kensington, College of Preceptors, Oxford Local, Cambridge Local, and other Examinations. These answers seem to us to be exceptionally correct, as, though we have tried them all, we differ from Mr. Magnus's results in only a dozen cases ; some of these cases are apparently clerical errors. We make this statement, taking into account two or three slips of errata which have been subsequently distributed by the author.

In Ex. 23, p. 86, 1·368th should be 1·368th, *i.e.*, $\frac{368}{1000}$; § 199, we think, would not be easy for the pupil unless he had some aid from a tutor. Some of the questions given to the Matriculation candidates of the University of London seem to us hardly suitable for them ; we shall select one, because even so experienced a teacher as the writer of the work we have noticed at first fell into an error. The question is : "Suppose that at the equator a straight, hollow tube were thrust vertically down towards the centre of the earth, and that a heavy body were dropped through the centre of such a tube. It would soon strike one side ; find which, giving a reason for your reply." The author gives an answer which we have heard